Proceedings of the Iowa Academy of Science

Volume 33 | Annual Issue Article 21

1926

Water Softening in the Home

Edward Bartow
State University of Iowa

WATER SOFTENING IN THE HOME

EDWARD BARTOW

In cities or villages the best method of obtaining soft water in the home is to have a city or village supply of soft water. If there is not a city or village supply, plan to get one and use the softest water available. If there is a supply of hard water, have it softened at the source, if it can be done economically. In other words, supplies of soft water must be obtained either from a water originally soft or a natural hard water must be softened. In the United States there are soft water supplies in New York city, Boston, Mass. and other eastern cities. A moderately soft water is obtained from the Great Lakes for Chicago, Milwaukee, Detroit, Cleveland, and other lake cities. Recently a natural soft water from the Ozark Hills has been piped to the city of Tulsa, Oklahoma, giving that city a great advantage over all cities of the southwest.

More and more cities obliged to use a hard natural supply are softening the water before it is distributed to the consummers through the mains. Notable examples are Columbus, Ohio, St. Louis, Missouri, New Orleans, La., and Cincinnati, Ohio. Recently Oklahoma City, Okla., has constructed a reservoir and water purification plant and has included the necessary equipment for softening the water. It is at present the most complete municipal water softening plant in the country.

Neither natural water or water softened except by the base exchange process at a central treatment plant are obsolutely soft. The hardness will vary from 3 to 10 grains per gallon. A good natural water may be considered to have a hardness of less than 10 grains per gallon and an excellent water less than 5 grains per gallon. Such water is often made more soft by treatment in the home.

There are two methods of treating hard water in the home to improve its condition, the lime soda process and the base exchange or zeolite process. These methods can be used to soften a city or village supply or to soften a hard water from a well.

Of the two methods, the oldest method is the lime-soda process using a mixture of lime and soda. The newer method known as

the base exchange or zeolite process has been introduced within the last 15 years.

The lime soda process should give a water containing less than five grains but not less than three grains of hardness to the gallon. The process is very satisfactory when water of constant composition like a well water is to be used. It is not so good with a water of varying hardness as from a river.

To soften a water by the lime-soda process, it is necessary to know the amount of lime and soda to add. The amount must be determined by analysis. The State of Iowa has a record of the analysis of many municipal supplies from which the amount of lime and soda to be used may be calculated. Information can be secured from the Iowa Geological Survey at Des Moines.

The Illinois State Water Survey, at Urbana, Illinois, has made examinations of the water from all public supplies in the state and has published a table showing the amount of lime and soda required for softening each supply. A similar table should be prepared for the municipal supplies of Iowa. It is possible in the state of Illinois to learn the amount of lime and soda required to soften any public supply. When the amount required is known, measure a definite amount, say 1000 gallons of water into a tank or cistern, add the required amount of chemicals, stir and let the sediment formed settle. This process is to be recommended especially in dry weather when cisterns are empty and a soft water needed.

It is possible to soften water on a smaller scale for household use; for example; a fifty gallon barrel may be filled with hard water, the required amount of lime and soda added, the mixture stirred, and the sediment formed allowed to settle. An acquaintance of mine who did not have good cistern water, has for a number of years, obtained softened water for the family washing this way.

The second method, the base exchange or zeolite process, is the most satisfactory as water with a variable amount of hardness can be treated and the hardness reduced to zero.

The process consists in passing the hard water through an artificial or natural mineral, which contains combined sodium in quantities proportionately larger than the combined calcium or magnesium contained in the water to be treated. The larger amount of sodium replaces the lesser amount of calcium and magnesium entering the mineral. When the mineral has taken up all the calcium and magnesium that it can, it is regenerated by driving out the calcium and magnesium with combined sodium

from ordinary salt. In regenerating, the sodium in the salt is present in much larger quantities than the calcium and magnesium in the mineral. The sodium enters the mineral and the mineral is regenerated. The softening and regeneration are accomplished by a chemical exchange that is called by the chemist, mass action. The larger quantity in each case takes the place of the smaller.

Base exchange minerals are either natural or artificial. An artificial mineral was first used. It was made by fusing together soda, sand, and alumina. It was later found that a similar product could be obtained by mixing a solution of sodium silicate and an alum salt and drying the jelly obtained. The artificial minerals now on the market are made by these methods or modifications of them.

The natural mineral is for the most part a glauconite or greensand found in New Jersey. It is used either in its natural state or treated with chemicals and roasted.

Weight for weight the artificial will soften more water than will the natural, but owing to the fact that the artificial is porous, the reaction both of softening and of regeneration is slower than is the similar action with the natural. With the natural mineral, the reaction takes place apparently on the surface. The capacity therefore of the two minerals may be approximately the same, as the time required for the artificial mineral of greater capacity may be equalized by the more rapid action in softening and regeneration of the natural mineral of less capacity.

Several manufacturers are placing apparatus containing base exchange minerals on the market. We will not, in this paper give the names of firms, but if anyone is interested and will write the Chemistry Department, University of Iowa, Iowa City, lists of firms and their addresses will be sent.

It hardly seems necessary to give information and reasons why soft water is of advantage. For the benefit of any who may be in doubt concerning its advantages, we will state a few of them.

A soft water uses less soap than hard water. It takes about sixty times as much soap as of lime to remove hardness from water.

Hard water will precipitate a lime soap on clothing in the laundry, giving white goods a dingy appearance.

Any goods washed in soft or softened water are softer than those washed in hard water.

Canned fruit and vegetables in which soft water is used are of better quality than those where hard water is used.

Soft water is pleasanter for bathing.

A hard water gives a scale in tea kettles, hot water boilers, steam and hot water heating systems. With a soft water the trouble is entirely eliminated.

In order to obtain the advantages of softened water, it is first necessary to choose the process which you desire to follow, the lime-soda process or the base exchange. If the lime-soda process is used, it will be necessary to find the amount to use per gallon or per 1000 gallons. An analysis can probably be made by the teacher of chemistry at a neighboring high school or college; a small fee will probably be charged. When you have decided how much is to be treated each time, and the necessary lime and soda, mix, stir thoroughly, and allow to settle for a few hours. By this means a reasonably soft water, 3 to 5 grains of hardness, can be obtained quite easily. The lime-soda process is more troublesome to operate than the base exchange or zeolite process.

As stated before the zeolite process gives a softer water. The expense of the machine is higher, costing $150 and up, according to size. It is best to get a machine that does not have to be regenerated oftener than once a week. The expenses of treatment besides the time required for regeneration will average possibly 10c per 1000 gallons treated. A hard water may require more and a soft water less. The cost is small compared with the benefits obtained. Any plumber can install the machine in a water line in a residence. The machine will require space not more than three feet square. It must be set up near a drain so that the wash water can be disposed of in a reservoir. The mineral will last for years so that the expense for renewals is small.

Friends of mine who have put in the zeolite systems are unanimously enthusiastic and agree that they would never be without it.

STATE UNIVERSITY OF IOWA,
IOWA CITY, IOWA.